

1. **(Currently amended)** A method for the determination of the location of a mobile station (MS) equipped with embedded GPS signal reception capability and equipped to operate within a wireless communications network, the method comprising:

(a) receiving GPS data at a land station, said GPS data being received from a MS to be located;

(b) at a land station equipped with location-measurement facilities, receiving a communications-band signal from said MS to be located and using the location-measurement facilities to extract location-related characteristic data from the communications-band signal, wherein said location-related characteristic data extracted from the communications-band signal is a function of the geographic location of said MS relative to said land station equipped with location-measurement facilities; and

(c) at a land station equipped for location-determination calculations, performing location-determination calculations using the GPS data and the extracted location-related characteristic data to derive an estimated location for the MS.

2. **(Previously presented)** A method as recited in claim 1, further comprising providing assistance data to the MS to be located, said assistance data enabling the MS to receive GPS signals and extract TOA or pseudorange measures, wherein said TOA or pseudorange measures are then communicated to the said land station equipped with location-measurement facilities.

3. **(Previously presented)** A method as recited in claim 1, further comprising communicating the GPS data and the extracted location-related characteristic data to said land station equipped for location- determination calculations.

4. **(Original)** A method as recited in claim 1, wherein said location-related characteristic data extracted from the communications-band signal includes time of arrival (TOA) data.

5.     **(Original)** A method as recited in claim 1, wherein said location-related characteristic data extracted from the communications-band signal includes time difference of arrival (TDOA) data.

6.     **(Original)** A method as recited in claim 1, wherein said location-related characteristic data extracted from the communications-band signal includes angle of arrival (AOA) data.

7.     **(Original)** A method as recited in claim 1, wherein said location-related characteristic data extracted from the communications-band signal includes data concerning signal strength or propagation loss (PL).

8.     **(Original)** A method as recited in claim 1, wherein said location-related characteristic data extracted from the communications-band signal includes timing advance (TA) data.

9.     **(Original)** A method as recited in claim 1, further comprising using collateral information in performing said location-determination calculations.

10.    **(Previously presented)** A method as recited in claim 1, wherein said method is employed to achieve applicable accuracy requirements for emergency services.

11.    **(Currently amended)** A system for the determination of the location of a mobile station (MS) equipped with embedded GPS signal reception capability and equipped to operate within a wireless communications network, comprising:

(a) means for receiving GPS data for use in location-determination calculations, said GPS data being received from a MS to be located;

(b) a land station equipped with location-measurement facilities and a receiver for receiving from said MS to be located a wireless communications-band signal and using the location-measurement facilities to extract location-related characteristic data from the

communications-band signal, wherein said location-related characteristic data extracted from the communications-band signal is a function of the geographic location of said MS relative to said land station equipped with location-measurement facilities; and

(c) a land station equipped for location-determination calculations, including a processor for performing location-determination calculations using the GPS data and the extracted location-related characteristic data to derive an estimated location for the MS.

12. **(Previously presented)** A system as recited in claim 11, further comprising means for communicating the GPS data and the extracted location-related characteristic data to said land station equipped for location-determination calculations.

13. **(Original)** A system as recited in claim 11, wherein said location-related characteristic data extracted from the communications-band signal includes time of arrival (TOA) data.

14. **(Original)** A system as recited in claim 11, wherein said location-related characteristic data extracted from the communications-band signal includes time difference of arrival (TDOA) data.

15. **(Original)** A system as recited in claim 11, wherein said location-related characteristic data extracted from the communications-band signal includes angle of arrival (AOA) data.

16. **(Original)** A system as recited in claim 11, wherein said location-related characteristic data extracted from the communications-band signal includes data concerning signal strength or propagation loss (PL).

17. **(Original)** A system as recited in claim 11, wherein said location-related characteristic data extracted from the communications-band signal includes timing advance (TA) data.

18. **(Original)** A system as recited in claim 11, further comprising using collateral information in performing said location-determination calculations.

19. **(Previously presented)** A system as recited in claim 11, wherein said system achieves applicable accuracy requirements for emergency services.

20. **(Previously presented)** A method as recited in claim 11, further comprising providing assistance data to the MS to be located, said assistance data enhancing the ability of the MS to receive GPS signals and extract TOA or pseudorange measures, wherein said TOA or pseudorange measures are then communicated to the said land station equipped with location-measurement facilities.

21. **(Previously presented)** A system as recited in claim 11, further comprising means for providing assistance data to the MS to be located, said assistance data enhancing the ability of the MS to receive GPS signals and extract TOA or pseudorange measures.

22. **(Previously presented)** A system for the determination of the location of a mobile station (MS) equipped with embedded GPS signal reception capability and equipped to operate within a wireless communications network based on the Global System for Mobile communications (GSM), the system comprising position-determination equipment (PDE) including: a plurality of location measurement units (LMUs) each of which is embedded at a networked land station (LS) for signal detection and processing, wherein each LMU is connected to and receives signals from a GPS antenna and from wireless communications band antenna(s); a serving mobile location center (SMLC) at a central collection-and-analysis land station (LS), said SMLC being configured to assemble measurements from the LMUs and to calculate the MS location; and a location gateway (LG ) at the central land station configured to receive location requests from a mobile positioning center (MPC) specifying the identity and serving cell assignment data for a MS of interest, said location gateway providing a PDE portal for the reception of location requests and for provision of location-determination results to the MPC;

wherein the system is programmed and configured to perform the following steps:

a request for the location of a particular MS of interest originating at the MPC is received at the LG, and the LG validates the authenticity and authorization for the location request, wherein a valid request identifies the serving cell and associated communications protocol parameters, including assigned frequency, that shall apply for the communications with the MS;

the LG provides the request to the SMLC appropriate for the determination of locations for MSs operating in the vicinity of the serving cell;

the selected SMLC receives and reviews any request to determine the list of cooperating LMUs that are optimal for supporting location requests associated with the identified serving cell;

in anticipation of the need to rapidly support a request for assisting GPS data, the SMLC maintains and evaluates current GPS configuration data that specify the location and motion parameters for the GPS satellite vehicles (SVs), wherein these data are persistently monitored by the LMUs through their GPS receivers, and wherein the LMUs provide to the SMLC the Doppler shifts, pseudoranges, and relevant demodulated navigation message data for the GPS SV telemetry streams received at the LMU positions;

the SMLC receives these GPS SV data periodically communicated from the LMUs, and for each potential serving cell, the SMLC evaluates and derives a current list that specifies the optimal SVs in potential view near the cell site, along with the restricted domains of Doppler shift and pseudorange that are anticipated to be appropriate for assisting in an AGPS reception; and

in order to exploit the availability of the up-to-date descriptions of the GPS configuration parameters to support a reduced time to first fix (TTFF) from the MS GPS receiver, the SMLC responds to a particular location request and provides the AGPS parameters appropriate for the vicinity of the serving cell site, wherein these AGPS parameters are received by the LG and are provided to the MPC to be communicated to the MS in a GPS data request.

23. **(Previously presented)** A system as recited in claim 22, wherein the SMLC also proceeds to request the development of data related to the MS location from all LMUs that are

optimally configured to cooperate in the determination of locations served by the identified cell site.

24. **(Previously presented)** A system as recited in claim 23, wherein the LMUs apply their signal acquisition and processing facilities to detect and extract the data appropriate for support of the location-determination calculations, and these LMU data are then provided to and received by the SMLC for integration into the location processing.

25. **(Previously presented)** A system as recited in claim 24, wherein, in support of the location determinations, the GPS data relevant to the MS location is sensed by the MS receiver with whatever assistance its processing facilities are configured to exploit, and the MS develops this data and communicates the data to the serving cell site for inclusion in the location calculations, wherein the MS's GPS data is provided to the PDE by way of the wireless communications system (WCS), and wherein the LG receives these data from the WCS or, optionally, the LMUs receive, demodulate, and provide the MS's GPS data from the MS response message.

26. **(Previously presented)** A system as recited in claim 25, wherein the SMLC receives the GPS information that the MS has provided for insertion into the integrated location-determination calculations.

27. **(Previously presented)** A system as recited in claim 26, wherein, with the data received from the LMUs and from the MS, the SMLC integrates all of the data in deriving an optimal probable estimate for the MS location parameters.

28. **(Previously presented)** A system as recited in claim 27, wherein the location-related measurements obtained from the cooperating LMUs include data of various forms and positional sensitivities from LMU positions and equipment that support various individual accuracies, and the GPS data may individually define or support stand-alone data location, with potential correctable biases, or may only provide pseudorange and Doppler measurements for a

limited, incomplete set of SV signals due to occlusion or distortion of the GPS signal propagation paths, and wherein the SMLC combines all of the data provided and integrates them into probability-based evaluations that incorporate whatever additional relevant collateral information is available to further condition the location estimate.

29. **(Previously presented)** A method for the determination of the location of a mobile station (MS) equipped with embedded GPS signal reception capability and equipped to operate within a wireless communications network, the method comprising:

- (a) providing assistance data to a MS to be located, said assistance data enabling the MS to receive GPS signals and extract TOA or pseudorange measures;
- (b) at a land station equipped with location-measurement facilities, receiving a communications-band signal from said MS to be located and using the location-measurement facilities to extract location-related characteristic data from the communications-band signal;
- (c) communicating the TOA or pseudorange measures and the extracted location-related characteristic data to a land station equipped for location-determination calculations; and
- (e) at said land station equipped for location-determination calculations, performing location-determination calculations using the GPS data and the extracted location-related characteristic data to derive an estimated location for the MS.

30. **(Previously presented)** A method as recited in claim 29, wherein said location-related characteristic data extracted from the communications-band signal includes time of arrival (TOA) data.

31. **(Previously presented)** A method as recited in claim 29, wherein said location-related characteristic data extracted from the communications-band signal includes time difference of arrival (TDOA) data.

32. **(Previously presented)** A method as recited in claim 29, wherein said location-related characteristic data extracted from the communications-band signal includes angle of arrival (AOA) data.

33. **(Previously presented)** A method as recited in claim 29, wherein said location-related characteristic data extracted from the communications-band signal includes data concerning signal strength or propagation loss (PL).

34. **(Previously presented)** A method as recited in claim 29, wherein said location-related characteristic data extracted from the communications-band signal includes timing advance (TA) data.

35. **(Previously presented)** A method as recited in claim 29, further comprising using collateral information in performing said location-determination calculations.

36. **(Previously presented)** A method as recited in claim 29, wherein said method is employed to achieve applicable accuracy requirements for emergency services.

37. **(Previously presented)** A method as recited in claim 29, wherein the wireless communications network is a GSM network, and the communications-band signal received from said MS complies with a GSM air interface specification.

38. **(Previously presented)** A method as recited in claim 29, wherein the wireless communications network is a non-GSM network, and the communications-band signal received from said MS complies with a non-GSM air interface specification.

39. **(Previously presented)** A system for the determination of the location of a mobile station (MS) equipped with embedded GPS signal reception capability and equipped to operate within a wireless communications network, the system comprising:



means for providing assistance data to a MS to be located, said assistance data enabling the MS to receive GPS signals and extract TOA or pseudorange measures;

a land station equipped with location-measurement facilities and configured to receive a communications-band signal from said MS to be located and to use the location-measurement facilities to extract location-related characteristic data from the communications-band signal; and

a land station equipped for location-determination calculations and configured to perform location-determination calculations using the GPS data and the extracted location-related characteristic data to derive an estimated location for the MS.

40. **(Previously presented)** A system as recited in claim 39, wherein said location-related characteristic data extracted from the communications-band signal includes time of arrival (TOA) data.

41. **(Previously presented)** A system as recited in claim 39, wherein said location-related characteristic data extracted from the communications-band signal includes time difference of arrival (TDOA) data.

42. **(Previously presented)** A system as recited in claim 39, wherein said location-related characteristic data extracted from the communications-band signal includes angle of arrival (AOA) data.

43. **(Previously presented)** A system as recited in claim 39, wherein said location-related characteristic data extracted from the communications-band signal includes data concerning signal strength or propagation loss (PL).

44. **(Previously presented)** A system as recited in claim 39, wherein said location-related characteristic data extracted from the communications-band signal includes timing advance (TA) data.

45. **(Previously presented)** A system as recited in claim 39, further comprising means for using collateral information in performing said location-determination calculations.

46. **(Previously presented)** A system as recited in claim 39, further comprising means for communicating the TOA or pseudorange measures and the extracted location-related characteristic data to said land station equipped for location-determination calculations.

47. **(Previously presented)** A system as recited in claim 39, wherein the wireless communications network is a GSM network, and the communications-band signal received from said MS complies with a GSM air interface specification.

48. **(Previously presented)** A system as recited in claim 39, wherein the wireless communications network is a non-GSM network, and the communications-band signal received from said MS complies with a non-GSM air interface specification.